

# A Brief History of $\pi$

$\pi$  has been known for almost 4000 years—but even if we calculated the number of seconds in those 4000 years and calculated  $\pi$  to that number of places, we would still only be approximating its actual value. Here's a brief history of finding  $\pi$ :

The ancient Babylonians calculated the area of a circle by taking 3 times the square of its radius, which gave a value of  $\pi = 3$ . One Babylonian tablet (ca. 1900–1680 BC) indicates a value of 3.125 for  $\pi$ , which is a closer approximation.

In the Egyptian *Rhind Papyrus* (ca. 1650 BC), there is evidence that the Egyptians calculated the area of a circle by a formula that gave the approximate value of 3.1605 for  $\pi$ .

The ancient cultures mentioned above found their approximations by measurement. The first calculation of  $\pi$  was done by Archimedes of Syracuse (287–212 BC), one of the greatest mathematicians of the ancient world. Archimedes approximated the area of a circle by using the Pythagorean Theorem to find the areas of two regular polygons: the polygon *inscribed within the circle* and the polygon *within which the circle was circumscribed*. Since the actual area of the circle lies between the areas of the inscribed and circumscribed polygons, the areas of the polygons gave upper and lower bounds for the area of the circle. Archimedes knew that he had not found the value of  $\pi$  but only an approximation within those limits. In this way, Archimedes showed that  $\pi$  is between  $3 \frac{1}{7}$  and  $3 \frac{10}{71}$ .

A similar approach was used by Zu Chongzhi (429–501), a brilliant Chinese mathematician and astronomer. Zu Chongzhi would not have been familiar with Archimedes' method—but because his book has been lost, little is known of his work. He calculated the value of the ratio of the circumference of a circle to its diameter to be  $355/113$ . To compute this accuracy for  $\pi$ , he must have started with an inscribed regular 24,576-gon and performed lengthy calculations involving hundreds of square roots carried out to 9 decimal places.

Mathematicians began using the Greek letter  $\pi$  in the 1700s. Introduced by William Jones in 1706, use of the symbol was popularized by Euler, who adopted it in 1737.

An 18<sup>th</sup> century French mathematician named Georges Buffon devised a way to calculate  $\pi$  based on probability. You can try it yourself at the Exploratorium exhibit *Throwing Pi*.

# 21st Anniversary of Pi Day

## Saturday, March 14

### 3/14 1:59pm

### (It's also Einstein's birthday!)

Info comes from: <http://www.exploratorium.edu/pi/>

What is Pi?

Pi is a number, starting with 3.1415926535... ad infinitum. It's the number you get when you divide the circumference of a circle by its diameter, and it can't be expressed as a fraction. It goes on forever.

Mathematicians began using the Greek letter  $\pi$  in the 1700s. Introduced by William Jones in 1706, use of the symbol was popularized by Euler, who adopted it in 1737.

#### Hat Sizes

Most hat sizes range between 6 and 8. Brainstorm ideas for how such sizes could be generated. ...Hat sizes must be related to the circumference of the head. The circumference of an adult's head usually ranges between 21 and 25 inches. The head's circumference divided by  $\pi$  gives us the hat size.

Info comes from: <http://www.joyofpi.com/pifacts.html>

In the 1996 film *Mission Impossible*, the secret code that Tom Cruise used to signal the conspirators was Job 3:14

Yasumasa Kanada (University of Tokyo) offers files for 4,200,000,000 digits of both  $\pi$  and  $1/\pi$  for anyone. To get more digits than that (you want more?) you'll need to register. There are also updates on latest records and other information.

#### World Record for # of digits memorized

|   |                 |              |             |       |             |                     |
|---|-----------------|--------------|-------------|-------|-------------|---------------------|
| 1 | <u>Lu, Chao</u> | <u>China</u> | <u>Asia</u> | 67890 | 20 Nov 2005 | <u>world record</u> |
|---|-----------------|--------------|-------------|-------|-------------|---------------------|

From Wikipedia:

The **Indiana Pi Bill** is the popular name for bill #246 of the 1897 sitting of the Indiana General Assembly, one of the most famous attempts to establish scientific truth by legislative fiat. Despite that name, the main result claimed by the bill is a method to square the circle, rather than to establish a certain value for  $\pi$ , although the bill does contain text that appears to dictate various incorrect values of  $\pi$ , such as 3.2. The bill never became law, thanks to the intervention of a mathematics professor from Purdue University who was incidentally present in the legislature.

## "American Pi"

lyric © 1997- 2007 Lawrence Mark Lesser; all rights reserved  
May be sung to the tune of Don McLean's "American Pie"

### INTRO:

A long, long time ago I can still remember  
How that mathematics made me smile.  
And I knew if I had my chance, I would ace geometry class  
And make my parents happy for a while.

But some math books made me shiver--  
Facts on tablets, all delivered:  
Nothing past the rational,  
And nothing transcendental.

I can't remember if I cried,  
Reading 3 point 1 4 1 5 9.....  
But something touched me deep inside  
The day I learned of pi...so:

Find, find the value of pi,  
Starts 3 point 1 4 1 5 9.  
Good ol' boys gave it a try,  
But the decimal never dies, the decimal never dies.....

In the Bible we do see the circle ratio appears as three,  
Or a little more....  
That genius Archimedes found with polygons, an upper bound  
Of 22 sevenths for sure!  
The Chinese got it really keen: three-five-five over one thirteen!  
More joined the action with arctan series and continued fractions.  
In the 1700's, my oh my, the English coined the symbol  $\pi$ ,  
Then Lambert showed it was a lie to look for rational pi.  
He started singing .....

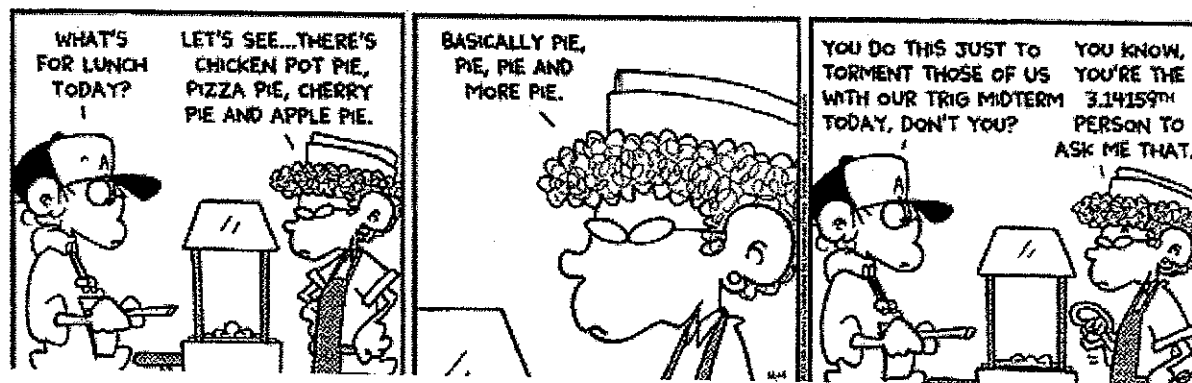
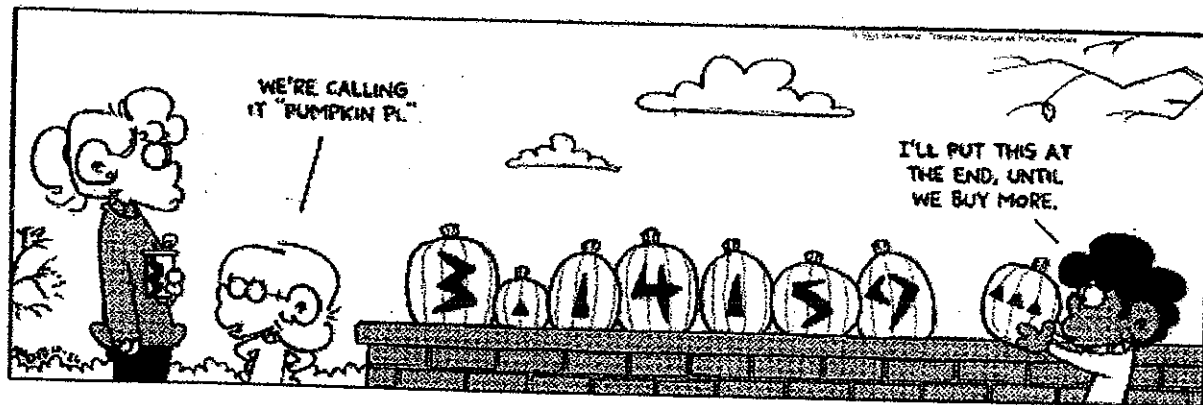
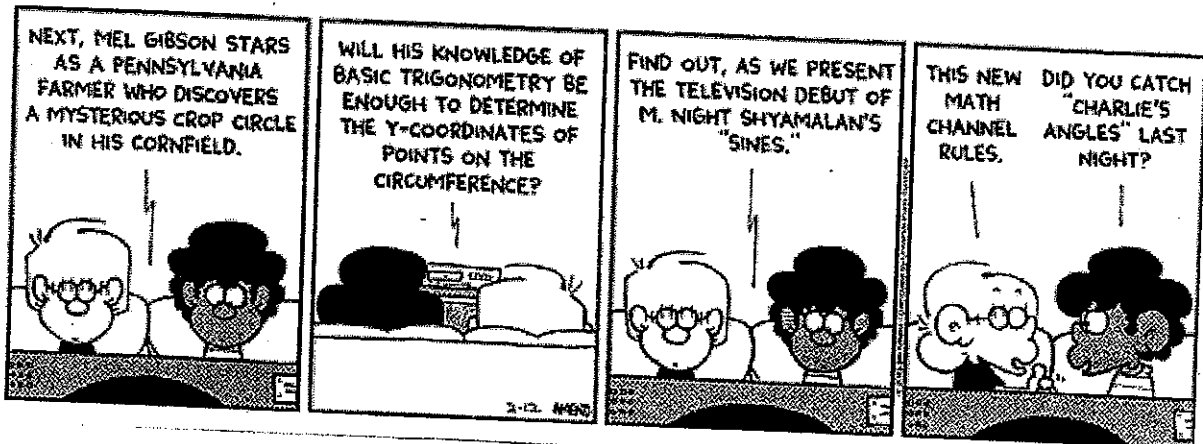
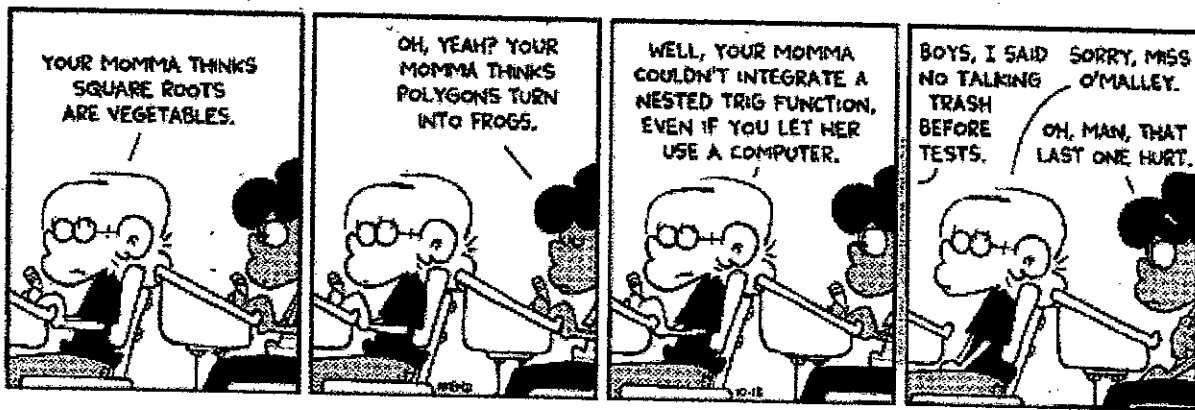
Find, find the value of pi  
Twice 11 over 7 is a mighty fine try  
A good ol' fraction you might hope to supply,  
But the decimal never dies, the decimal never dies.

Late 1800's, Lindemann shared why a circle can't be squared  
But some folks tried anyway--  
Like the Indiana doctor who said pi was 4 or 3.2  
And thought his proof should be a law someday.  
The Indiana congressmen  
Discussed his paper there and then  
A bill got through the House by a vote unanimous!  
But in the end the statesmen sighed, "It's not for us to decide,"  
So the bill was left to die like the quest for rational pi.  
They started singing .....

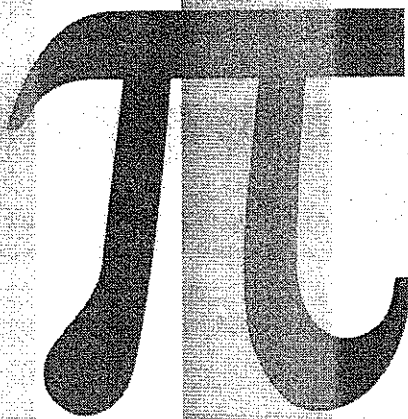
Find, find the value of pi  
Buffon's needle popped the bubble of that ol' doctor's try  
A good ol' fraction could not be supplied  
'Cause the decimal never dies, the decimal never dies.

That doctor's pi in the sky dreams may not look so extreme  
'Cause we long believed  
Deductive systems could be complete and there was one true geometry.  
But now there's more we see  
In these computer times, we test the best machines to find  
pi to a trillion places that so far lack pattern's traces.  
It's great when we can truly see math as human history--  
That adds curiosity..... easy as pi!  
Let's all try singing.....

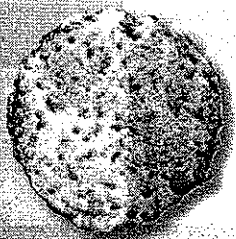
Find, find the value of pi  
3 point 1 4 1 5 9 2 6 5 3 5 8 9...  
A good ol' fraction you might hope to define  
But the decimal never dies, the decimal never dies.



Easy as



area  
comparison



small

12"

$36\pi$

-27%

-44%

-56%



medium

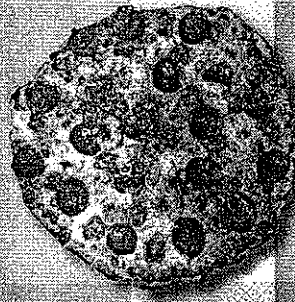
14"

+36%

$49\pi$

-23%

-40%



large

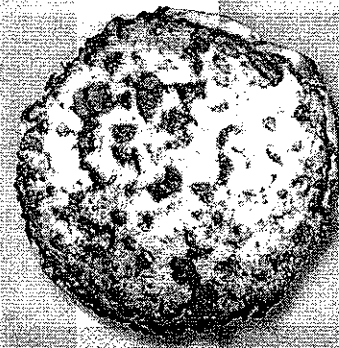
16"

+78%

+31%

$64\pi$

-21%



extra-large

18"

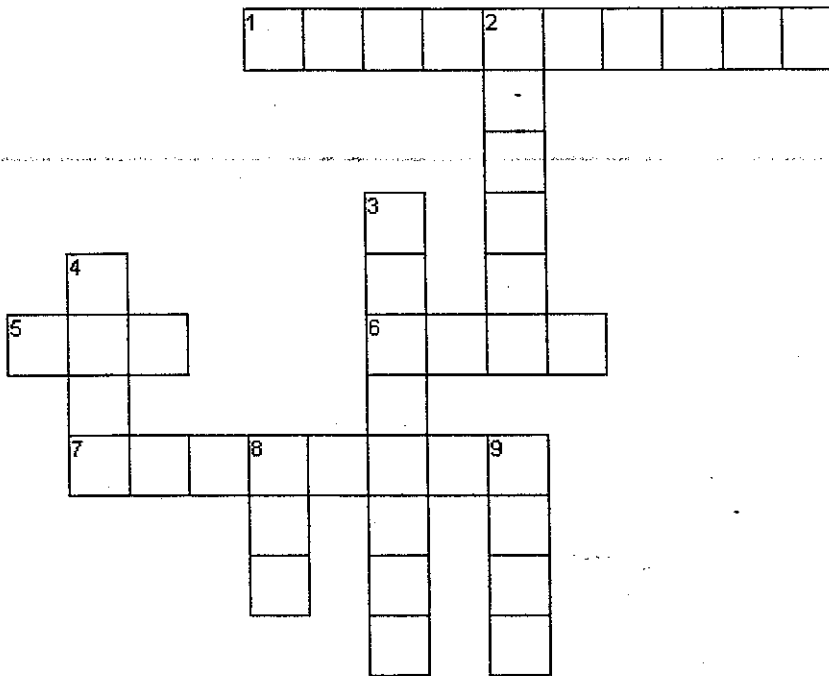
+125%

+65%

+27%

$81\pi$

# HAPPY PI DAY!



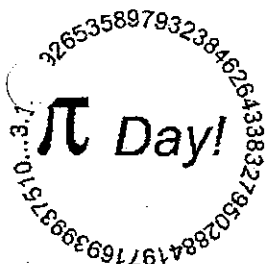
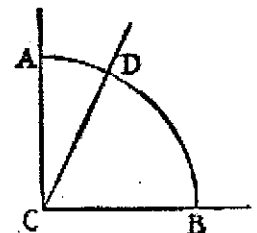
USE THE FACTS ON THE BACK OF THE SHEET TO COMPLETE THE PUZZLE.

## Across

1. the man is protesting that "pi is a rational number" is funny because everyone knows that pi is \_\_\_\_\_.
5. the third cartoon on the left is funny because while the man is talking about pi, the other man is imagining \_\_\_\_\_.
6. We multiply pi times the square of the radius to find the \_\_\_\_\_ of a circle.
7. the guy at the top of this page was lucky enough to be born on March 14th.

## Down

2. the age of the young boy that memorized pi to 4000 decimal places
3. We calculate circumference of the circle by multiplying this by pi
4. the fifth digit of pi
8. A fascinating fact about pi is that the 360th digit of pi is this number - fascinating when you consider that there are 360 degrees in a circle.
9. the number of hours that it took to recite the world record of 42,000 digits of pi



## What is pi?

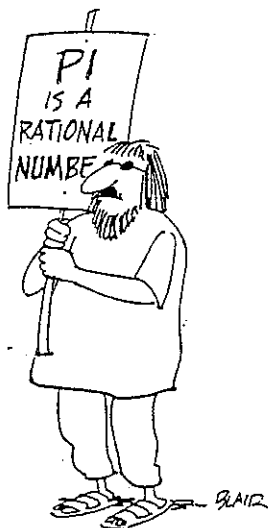
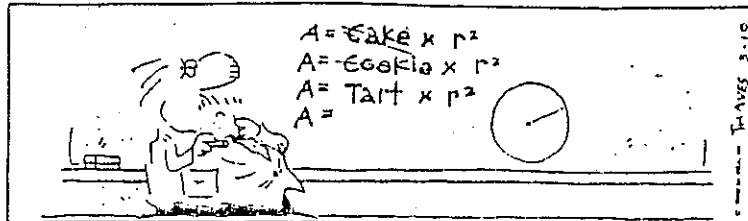
Mathematician: Pi is the number expressing the relationship between the circumference of a circle and its diameter.

Physicist: Pi is 3.1415927 plus or minus 0.000000005.

Engineer: Pi is about 3.

$\pi$

FRANK & ERNEST® by Bob Thaves



From Blair's By the Numbers

In April 1995, the Reuters wire service reported that a twelve-year-old Chinese boy, Zhang Zhuo, recited the value of pi to 4,000 decimal places from memory. Apparently, this took him just over twenty-five minutes.

Hiroynki Goto set a new world record in February, 1995 by reciting pi to 42,000 places from memory. It took him just over 9 hours.

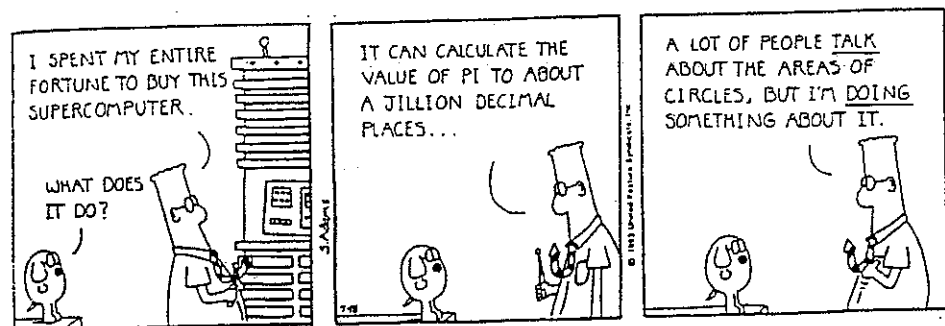
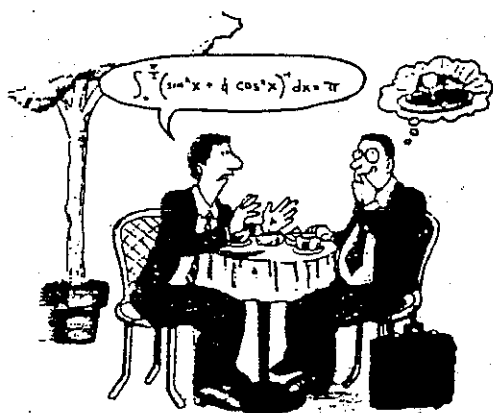
DRABBLE® by Kevin Fagan



You can determine your hat size by measuring the circumference of your head, then divide by pi, and round off to the nearest one-eighth inch.

visit **THE JOY OF  $\pi$**  web site:  
[www.joyofpi.com](http://www.joyofpi.com)

Since there are 360 degrees in a circle and pi is intimately connected with the circle, we eagerly look at [the 360th digit]. Again we are rewarded with a most remarkable fact. At [the 359th digit] we find 360. Thus 360 is "centered" over [the 360th digit]. —Monte Zenger, "The Magic of Pi," 1979



From The Joy of Pi, David Blatner